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Fg. 6 Glass pump
used with a
capping mech.

PATENT ABSTRACTS OF JAPAN

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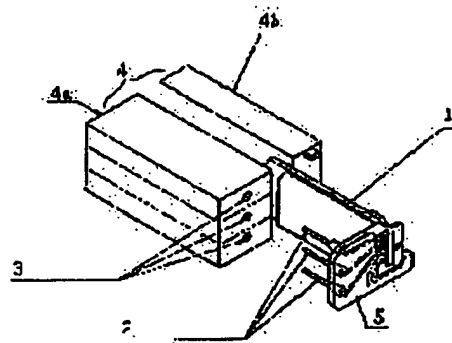
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(54) INK JET PRINTER

(57)Abstract:

PURPOSE: To carry out suction work even when an ink tank becomes vacant preventing a nozzle communicating with the vacant tank from communicating with outside air at other part than a discharge opening when ink is to be sucked by one suction pump in a state that one ink tank among a plurality of ink tanks is vacant.

CONSTITUTION: An ink jet printer comprises one or more ink jet head 1 having a plurality of nozzles for discharging liquid drops, one or more ink tank for supplying ink to the ink jet head 1 through an ink passage 2, and a sucking pump for sucking the ink from all nozzle discharging openings of the ink jet head 1 simultaneously. At sucking by the sucking pump in a state that one or more of ink tank is vacant, the nozzle which communicates with the vacant tank is prevented from communicating with outside air at other part than the discharging opening. As a result, sucking the work can be carried out even when the tank is vacant and excellent printing can be accomplished regardless of the presence or absence of the ink in the ink tank.



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CLAIMS

[Claim(s)]

[Claim 1] (1) One or more ink jet heads which have two or more nozzles which carry out the regurgitation of the drop, (2) One or more ink tanks which supply ink to this ink jet head through ink passage, And it sets to the ink jet printer which has one suction pump which attracts ink from all the nozzle deliveries of (3) this ink jet head to coincidence. The ink jet printer characterized by the nozzle which one or more ink tanks open for free passage on this empty tank at the time of suction by the suction pump in the state of the sky not being open for free passage in the open air except a delivery.

[Claim 2] The ink jet printer according to claim 1 whose ink tank is the closed mold which does not have free passage opening with the open air.

[Claim 3] (1) The ink jet printer according to claim 1 or 2 which has the amount control means of suction ink which adjusts the total amount of suction of ink based on the detection information from an empty ink tank detection means and (2) this detection means, and sets constant substantially the amount of suction ink per nozzle.

[Claim 4] The ink jet printer according to claim 3 whose amount control means of suction ink is a piston pump strange possible [a stroke].

[Claim 5] The ink jet printer according to claim 3 whose amount control means of suction ink is the gear pump which has an engine-speed adjustable motor.

[Claim 6] (1) An ink jet printer given in claim 3 whose a (2) sky ink tank detection means it is the head to which an ink jet head has a heater for regurgitation inside a nozzle, and carries out the regurgitation of the ink droplet to a heater using growth of the air bubbles energized and produced, and is a head temperature detection means thru/or any 1 term of 5.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]**[0001]**

[Industrial Application] This invention relates to an ink jet printer and the ink jet printer recorded in the ink of an especially different color or concentration.

[0002]

[Description of the Prior Art] The spread of ink jet printers is expanded as a printer with a high recording rate by the low noise and the low running cost.

[0003] In this ink jet printer, the increment in viscosity of the ink by the moisture evaporation on the property using liquid ink and in ink is unavoidable. The non-regurgitation and imperfect regurgitation by nozzle blinding arise by such increment in viscosity, and image grace falls. In order to prevent this, the following measures are taken from before.

[0004] 1) after being left with long duration record not carried out, a nozzle is deep, the increment in viscosity of ink is attained until, and the regurgitation is impossible. Then, purge actuation which uses a suction pump and discharges the ink which carried out the increment in viscosity is carried out.

[0005] 2) In the printer on demand which carries a multi-nozzle head, a certain nozzle which does not carry out the time amount regurgitation may arise during printing. If this non-regurgitation nozzle passes beyond fixed time amount, it will start blinding. Then, before resulting in this time amount, regardless of an image, from all nozzles, the regurgitation is performed and blinding is prevented. This measure is called the reserve regurgitation.

[0006] On the other hand, the commercial scene of the color ink jet printer which performs discharge and color picture record with a predetermined nozzle has expanded the ink of a different color.

[0007] It is in it, and in a personal youth's small color ink jet printer, the present condition is that record of character printing in black ink, a graph ruled line, etc. occupies 70%, and the graphic record in color ink is expected to be about 30%. Therefore, even if a color ink tank becomes empty, it is surmised for a while that many users who use it as a monochrome printer as it is exist.

[0008] Also in this color ink jet printer, above-mentioned purge actuation and the above-mentioned reserve regurgitation of 1 and 2 are required. About purge actuation, when the suction pump corresponding to the nozzles of each of a different color is prepared, the pump of yellow, MAZENDA, cyanogen, and the four totals for blacks is needed. Therefore, the approach one pump performs ink suction to coincidence from all nozzles is enforced widely.

[0009]

[Problem(s) to be Solved by the Invention] However, there are the following troubles in the above-mentioned conventional example.

[0010] The free passage hole with the open air is established in the conventional ink tank for ink supply. Therefore, when the ink in a tank becomes empty, a nozzle will be open for free passage with the open air through a tank free passage hole.

[0011] Therefore, since air is attracted from the nozzle which it has connected to an empty tank by the state of the sky even if one ink tank tends to carry out ink suction from all nozzles at

coincidence, ink suction from other nozzles becomes impossible.

[0012] Therefore, by the printer it is expected to be to use it as a monochrome printer even if a color ink tank becomes empty like the aforementioned small personal printer, when one color tank becomes empty, suction becomes impossible. That is, purge operating becomes impossible and there is a trouble of subsequent normal printing becoming impossible.

[0013] Moreover, temporarily, since the total amount of ink attracted with a suction pump during one purge actuation also as a configuration in which purge actuation is possible is constant value, an empty tank follows it on increasing, and the amount of suction per nozzle increases and has the trouble of wasting the ink more than the amount of suction required in order to hold normal printing.

[0014]

[Means for Solving the Problem] One or more ink jet heads on which this invention has at least two or more nozzles which carry out the regurgitation of the (1) drop, (2) One or more ink tanks which supply ink to this ink jet head through ink passage, And it sets to the ink jet printer which has one suction pump which attracts ink from all the nozzle deliveries of (3) this ink jet head to coincidence. The ink jet printer characterized by the nozzle which one or more ink tanks open for free passage on this empty tank at the time of suction by the suction pump in the state of the sky not being open for free passage in the open air except a delivery is offered.

[0015] Furthermore, this invention offers the ink jet printer which has the amount control means of suction ink which controls an ink suction total amount based on the detection information from a (1) sky ink tank detection means and (2) this detection means.

[0016] Especially, also in an ink jet recording method, this invention forms a flight drop using heat energy, and brings about the outstanding effectiveness in the recording device of the ink jet recording method which records.

[0017] About the typical configuration and typical principle, for example, it is indicated by the U.S. Pat. No. 4723129 specification and the 4740796 specification, and, as for this invention, what is performed using these fundamental principles is desirable. This recording method is applicable to both the so-called mold on demand and the Continuation mold.

[0018] When this recording method is explained briefly, heat energy is made to generate and the heat operating surface of a recording head is made to produce film boiling by exceeding a nucleate-boiling phenomenon into a liquid (ink) corresponding to recording information, and impressing at least one driving signal for giving a rapid temperature rise which produces a film-boiling phenomenon to the electric thermal-conversion object arranged corresponding to the sheet and liquid route where the liquid (ink) is held. Thus, since the air bubbles which carried out the one to one correspondence to the driving signal given to an electric thermal-conversion object from a liquid (ink) can be formed, it is especially effective in the method of recording a mold on demand. A liquid (ink) is made to breathe out through a discharge opening by growth of these air bubbles, and contraction, and at least one drop is formed. If this driving signal is made into the shape of a pulse form, since growth contraction of air bubbles will be performed appropriately instantly, the regurgitation of a liquid (ink) excellent in especially responsibility can be attained, and it is more desirable. As a driving signal of the shape of this pulse form, what is indicated by the U.S. Pat. No. 4463359 specification and this No. 4345262 specification is **** (ed). In addition, if the conditions indicated by the U.S. Pat. No. 4313124 specification of invention about the rate of a temperature rise of the above-mentioned heat operating surface are adopted, further excellent record can be performed.

[0019] A thing with the configuration arranged to the field to which the heat operation section is crooked is also contained in this invention as indicated by the U.S. Pat. No. 4558333 specification and U.S. Pat. No. 4459600 specification other than a configuration (a straight-line-like liquid flow channel or right-angle liquid flow channel) of having combined a discharge opening which is indicated by each above-mentioned specification, the liquid flow channel, and the electric thermal-conversion object as a configuration of a recording head.

[0020] In addition, also in the configuration based on the Provisional-Publication-No. 59 No. 138461 official report per year which indicates the configuration whose puncturing which absorbs the pressure wave of the Provisional-Publication-No. 59 No. 123670 official report per year

which indicates the configuration which uses a common slit as the discharge opening of an electric thermal-conversion object to two or more electric thermal-conversion objects, or heat energy is made to correspond to a discharge part, this invention is effective.

[0021] Furthermore, as a recording head for which this invention is used effectively, there is a full line type recording head of the die length corresponding to the maximum width of the record medium which can record a recording device. This full line head may be what was made the full line configuration, and a full line recording head of a piece formed in one by combining two or more recording heads which are indicated by the specification mentioned above.

[0022] In addition, this invention is effective also when the recording head of the exchangeable chip type with which the electric connection with the body of equipment and supply of the ink from the body of equipment are attained, or the recording head of the cartridge type formed in the recording head itself in one is used by the body of equipment being equipped.

[0023] Moreover, since the recording device of this invention can be further made stability, it is desirable to add the recovery means against a recording head, a preliminary auxiliary means, etc. to the recording device of this invention. If these are mentioned concretely, it is effective in order to perform record stabilized by adding the preheating means by the capping means, the cleaning means, the pressurization or the suction means, the electric thermal-conversion object, the heating elements different from this, or such combination over a recording head, and a means to perform reserve regurgitation mode different from record.

[0024] Furthermore, although any of what constituted not only the mode that records only which black mainstream color as a recording mode of a recording device but the recording head combining what was constituted in one, and plurality are sufficient, this invention is very effective also in equipment equipped with full color at least one by the double color color or color mixture of a different color.

[0025] By the above explanation, although explained using liquid ink, even if it is ink which will be in a softening condition at a room temperature even if it is ink which is a solid-state-like at a room temperature, it can use by this invention. With above-mentioned ink jet equipment, since what carries out temperature control is common as a temperature control is performed for ink itself within the limits of 30 degrees C or more 70 degrees C or less and it is in the stabilization regurgitation range about the viscosity of ink, ink should just make the shape of liquid at the time of use record signal grant.

[0026] In addition, the ink which prevents positively by making the superfluous temperature up of the head by heat energy or ink use it as energy of the change of state from a solid condition to the liquid condition of ink, or is solidified in the state of neglect for the purpose of antilashing of ink can also be used. Anyway, when reaching the thing and record medium which ink liquefies and carry out the regurgitation as the shape of liquid ink by grant according to the record signal of heat energy, use of ink with the property which will not be liquefied without grant of heat energy, such as what it is already begun to solidify, is also applicable to this invention.

[0027] Such ink is good for a crevice or a through tube of a porosity sheet which is indicated by JP,54-56847,A or JP,60-71260,A also as liquefied or a gestalt which counters to an electric thermal-conversion object in the condition of having been held as a solid.

[0028] In this invention, the most effective thing performs the film-boiling method mentioned above to each ink mentioned above.

[0029] Drawing 9 is the appearance perspective view showing an example of an ink jet recording device (IJRA) which equipped with the recording head as an ink jet head cartlidge (IJC).

[0030] In drawing, 120 is the ink jet head cartlidge (IJC) equipped with the nozzle group which counters the recording surface of the detail paper by which paper feed has been carried out on a platen 124, and performs the ink regurgitation. 116 is the carriage HC holding IJC120, and the both-way migration of it covering full [of the recording paper of IJC120] is attained by connecting with some driving belts 118 which transmit the driving force of a drive motor 117, and enabling two guide shafts 119A and 119B each other arranged in parallel and sliding.

[0031] 126 is a head recovery device and is arranged in the end of the moving trucking of IJC120, for example, a home position, and the location which counters. With the driving force of the motor 122 through a driving mechanism 123, the head recovery device 126 is made to

operate and capping of IJC120 is performed. It is made to relate to capping to IJC120 by cap section 126A of this head recovery device 126, ink feeding by the proper pressurization means formed in ink suction by the proper suction means established in the head recovery device 126 or the ink supply path to IJC120 is performed, and regurgitation recovery of removing the thickening ink in a nozzle is performed by making ink discharge more compulsorily than a delivery. Moreover, IJC is protected by performing capping at the time of record termination etc.

[0032] 130 is a blade as a wiping member which is arranged in the side face of the head recovery device 126, and is formed by silicone rubber. A blade 130 is held with a cantilever gestalt at blade attachment component 130A, like the head recovery device 126, it operates according to a motor 122 and a driving mechanism 123, and engagement to the regurgitation side of IJC120 of it is attained. By this, are the suitable timing in record actuation of IJC120, or a blade 130 is made to project in the moving trucking of IJC120 after the regurgitation recovery using the head recovery device 126, and it is the thing [in / in connection with migration actuation of IJC120 / the regurgitation side of IJC120] which dewes, gets wet or wipes off dust etc.

[0033] After the tank of either of two or more tanks has become empty, in case ink is attracted with one suction pump in the ink jet head which has two or more ink tanks according to this invention, when making it not open for free passage [the nozzle which was open for free passage on the empty tank] with the open air except a delivery, even if a tank becomes empty, it can be made to perform suction actuation.

[0034] Moreover, the amount of suction per nozzle is always kept constant by establishing the amount control means of suction ink which adjusts the total amount of ink attracted in one purge actuation according to the number of empty tanks in addition to the above-mentioned means.

[0035]

[Example] Next, an example explains this invention concretely.

[0036] (Example 1) Drawing 2 is drawing of one example of the ink jet head [of this invention], and ink tank circumference. The ink jet head to which one carries out the regurgitation of the ink according to a record signal, the ink delivery pipe with which 2 was prepared in the ink jet head, the ink feed holes by which 3 was prepared in the ink cartridge 4, and 4 are ink cartridges which have ink of two or more colors inside among drawing.

[0037] The recording head 1 has the following composition. The recording head 1 has the group of the nozzle for the object for yellow, the object for MAZENDA, the object for cyanogen, and blacks on the straight line in the front end section. Each group does 64 nozzle ** of 24 every nozzles and the object for blacks for the object for yellow, the object for MAZENDA, and the object for cyanogen, and it has spacing of 16 nozzles between an equivalent for eight nozzles, cyanogen, and black between color nozzles. The ink passage which is open for free passage to a delivery is established in each of these deliveries, and the common liquid room for supplying ink to these liquid routes is prepared behind [that ink passage is arranged] a part.

[0038] Electrode wiring for supplying power to the electric thermal-conversion object and this which generate the heat energy used in order to carry out the regurgitation of the ink droplet from these deliveries is prepared in the liquid ink way corresponding to each of a delivery. These electrical-and-electric-equipment thermal-conversion object and electrode wiring are formed by the membrane formation technique on the substrate which consists of silicon etc. Furthermore, the above-mentioned delivery, a liquid ink way, and a common liquid room are constituted by carrying out the laminating of a septum, a top plate, etc. which consist of resin and glass material on this substrate. Furthermore, the drive circuit for driving the above-mentioned electric thermal-conversion object based on a record signal is established in back with the printed circuit board gestalt. The above-mentioned silicon substrate and the printed circuit board are being fixed on the same aluminum plate.

[0039] 4a for colors (the object for yellow, the object for MAZENDA, for cyanogen) in an ink cartridge 4 and 4b for blacks are prepared. An ink cartridge 4 is inserted almost in parallel with an aluminum plate, and, similarly connects with an aluminum plate and the ink delivery pipe which projected to parallel. The ink delivery pipe has projected from the plastics member 5 called the

distributor which spread perpendicularly to the silicon substrate, it is further open for free passage with the passage of the distributor 5 interior, and the passage is open for free passage in the common liquid room.

[0040] It existed the object for yellow, the object for MAZENDA, the object for cyanogen, and for [four] blacks, and the ink path in said distributor 5 has connected each common liquid room and ink delivery pipe 2. Since an ink cartridge 4 distributes 4a for colors (the object for yellow, the object for MAZENDA, for cyanogen), and 4b for blacks to right and left and is arranged to the aluminum plate, it can also distribute said ink delivery pipe 2 to 3 and 1.

[0041] Drawing 1 is the sectional view showing the interior of ink cartridge 4b of black. The principle of the same is said of color ink cartridge 4a. The ink bag 25 exists in the interior of an ink cartridge, and it fills up with ink in a bag. Furthermore in the bag, two negative pressure plates 26 are contained, and, as for this [push], the compression negative pressure spring 27 is inside a plate. Negative pressure is given to ink according to the load of this spring, and, also in an unexpected vibration, ink jumps out of a nozzle. The lower limit of the ink bag 25 is pasted up on the seal mold 28. Seal rubber 29 is pressed fit in the center section of seal mold. Although the hole which inserts the ink delivery pipe 2 is open to rubber, since it has closed with elasticity when the pipe is not contained, ink does not fall.

[0042] Drawing 4 is a perspective view showing the whole ink jet printer which used an above-mentioned ink jet head and an above-mentioned ink cartridge.

[0043] The ink jet head 1 and an ink cartridge (4a+4b) are fixed to carriage 7. This carriage 7 is supported by guide A (10) and guide B (11), and can reciprocate in the 14 directions of drawing. At this time, it moves in the regurgitation side of a head 1, with the recording paper 6 and 1mm path clearance maintained. In addition, 9 is a leading screw, and it connects with a non-illustrated motor and it rotates. Carriage 7 reciprocates synchronizing with rotation of a leading screw.

[0044] The detail paper 6 is pinched by the paper feed roller 8 and the non-illustrated pinch roller, and is sent in the 15 directions. Furthermore, the recording paper 6 is pinched by the delivery roller 12 and the spur 16, between a delivery roller and a paper feed motor, it can give a tension and flat-surface maintenance is carried out.

[0045] 13 is a purge unit and explains a detail using drawing 3. Drawing 3 is the sectional view of a purge unit. Cap rubber 17 is fixed to the head delivery opposite side of the purge box 18. At the time of un-recording, with a means by which it does not illustrate, the whole unit moves in the 23 directions and sticks the regurgitation side of a head to this cap rubber. Thereby, the moisture evaporation in ink can be prevented. The cylinder 21 is inserted in the side face of the purge box 18. A piston 22 can be reciprocated within a cylinder. A piston is driven by stepping MODA through the device in which it does not illustrate. It can stop correctly at four points of a, b, c, and d by starting from the piston location shown as the continuous line of drawing, and changing the number of input pulses to a motor. Therefore, four steps of the amounts of suction can be chosen. Time amount change of the negative pressure in the purge box at this time is shown in drawing 7. After cap rubber pushes on a head delivery and hits, if the piston retreats, air will be attracted first, the meniscus currently formed in the nozzle end face by the time amount t of drawing 7 is destroyed, and ink begins to be attracted. Negative pressure at this time - If p, this negative pressure will be maintained until a piston stops henceforth. a, b and c of drawing 7, and d point -- a, b, c, and d of drawing 3 -- it is a point corresponding to each stroke. If a piston is stopped at these points, four steps of the amounts of suction can be chosen.

[0046] Furthermore joint 19 is inserted in the purge box 18, and the ink absorber 20 is inserted into joint. The ink absorber 20 passes along the inside of the silicon tube 24, and results even to a non-illustrated waste ink tank. The ink attracted from the nozzle of a head by piston actuation is thrown away into a waste ink tank through an ink absorber.

[0047] Next, equipment actuation is explained.

[0048] The head delivery is pressed against cap rubber at the time of equipment starting. Next, the recording paper 6 is sent to a printing starting position. A head performs black and the reserve regurgitation of the color of 50 shots each, pushing and hitting a purge unit. At this time,

Fig. 3
Piston
pump
i
Capping
device

← Capping
piston
device

ink waste
air
ink

the temperature sensor which is not illustrated [which was prepared on the head] detects head substrate temperature. If one of tanks are empty among four tanks, since a regurgitation heater will be in a heating-with-nothing-inside condition, the temperature up of it will be carried out unusually. And when a black tank becomes empty temporarily, when heating with nothing inside and one color ink tank shot become [64 heaters] empty, 24 heaters are heated with nothing inside, the injection energy to a head substrate differs by each case, and a difference appears in a temperature rise value. Therefore, if a temperature rise value is detected, an empty tank can perform distinction of whether it is black, whether it is a color, and how many piece sky a color is. In the case of this example, distinction becomes possible by having the distinction table of eight kinds of temperature rise values. In addition, since the reserve regurgitation is carried out once to carriage 10 scan, it is possible to perform temperature detection to whenever [the] and to perform existence distinction of an empty tank.

[0049] Although character printing in black ink can be performed even after, as for the printer of this example, color ink is lost, when black ink is lost, an equipment halt is carried out automatically, and it becomes the exchange waiting of the black ink cartridge by the user.

[0050] Next, if a printing signal is inputted, carriage will scan and the regurgitation will be performed to the timing of 360 dots per inch. In that case, 64 black nozzles are used in character printing, and inside of black nozzle 24 nozzle is used by graphic printing. If printing of one line finishes, at the time of character printing, the recording paper will be sent by 24 dots at the time of 64 dots and graphic printing. 1 page is printed like the following and paper is delivered. If record is continued, when newly not feeding paper, carriage moves to the front face of a purge unit, a unit moves forward, and a head delivery is capped.

[0051] Purge actuation has the mode performed at any time and the mode automatically purged when left for three days, without recording, when a user pushes a purge carbon button. The existence of an empty tank is detected, and when you have no empty tank, when one color tank is empty, the total amount of suction can always be uniformly controlled by the approach of the abnormality temperature up detection which mentioned above in any case to c lines to b lines to a lines of drawing 1 in condition of being d lines in the case of three-piece sky, at the time of two-piece sky. In addition, when black ink becomes empty, as mentioned above, equipment becomes recordable, as soon as it stops automatically and cartridge exchange is completed.

[0052] (Example 2) Next, the example of the head of ink tank one apparatus is explained using drawing 5. In this case, four heads 30 of ink tank one apparatus are carried. The interior of a tank has adopted the bag method of closed mold like an example 1. The head is juxtaposed in order of drawing on carriage 7. Discharge and record are performed in piles in order of cyanogen, MAZENDA, yellow, and black, carriage moving along with the detail paper.

[0053] 31 is a cap and has four openings corresponding to the regurgitation side of a tank one apparatus head. These four openings are connected with one room inside. The hole has penetrated in the background of this room and the gear pump 32 has connected through the suction tube 34. Furthermore, the ** ink tube 33 has connected with a gear pump.

[0054] The internal structure of a gear pump is shown in drawing 6. 38 is the pump gear A, 39 is the pump gear B, and it has geared mutually. 35 is ink suction opening and the suction tube 34 of drawing 5 connects it here. Similarly, 36 is an ink exhaust port and the ** ink tube 33 is connected. The pump gear A and the pump gear B are put in into the HOMPU casing 37. The addendum at that time and the path clearance of casing are 0.1mm. If two gears rotate in the direction of an arrow head of drawing 6, ink will flow from suction opening to an exhaust port. This gear pump is driven with a DC motor or a stepping motor, and it becomes easy by controlling the rotational frequency of a motor to choose the amount of ink suction.

[0055] (Example 3) Next, the example of another ink jet head is shown using drawing 8. In this case, it is the discrete type by which the recording head was connected with the ink tank through the ink tube 51. Moreover, in the examples 1 and 2, although it was the method which generates negative pressure in a sealing bag using a negative pressure spring, negative pressure is generated by establishing the open hole which is open for free passage to atmospheric air in this case in a tank 40, and installing an ink tank in a location lower 20cm than a head. Non-illustrated rubber is inserted in an open hole, and since it is the structure where a detailed hole

exists in the center of rubber, ink ***** does not occur.

[0056] In this drawing, it is an ink tank, and yellow, MAZENDA, cyanogen, and four blacks exist and, as for 40, the same tank supplies ink to the head which is not illustrated corresponding to each. An ink tank can be taken out and inserted in the direction of 52, and can be fixed by the position by the tank stationary plate 42. The ink delivery pipe 46 penetrates to the seal rubber 45 currently fixed at the tip of a tank in that case. A tank point resists the spring force and pushes caudad on coincidence the valve 43 which was pushed by the compression valve spring 48 and has run against joint 47. Although the seal bush 44 made of rubber is inserted in the interior of a valve and the condition that a tank cannot be reached has closed the ink hole 53, if equipped with a tank, a valve 43 will move, an ink hole is open for free passage on a tank, and the ink supply of it is attained. Ink results in a head through the ink passage joint 49, the tube joint 50, and the ink tube 51. An ink tank is extracted when a tank becomes empty. Thereby, touching of the nozzle of a head with atmospheric air except a delivery is lost, and purge actuation stated in the example 1 can be carried out.

[0057] As explained above, the application range of this invention is [in / it is large and / the equipment of various classes] realizable.

[0058]

[Effect of the Invention] Since the formation of purge actuation is possible for some, they can guarantee good printing irrespective of the existence of the ink in a tank also by the state of the sky among the ink tanks of (1) plurality by this invention, as explained above. You that character printing also sometimes performs graphic printing especially at the core of record For THE It bases [for the time being] on black and is good even after color ink is lost. The printer which can perform character printing can be offered. (2) Even if there is an empty ink tank, the amount of ink suction per nozzle at the time of purge actuation is made uniformly, and it prevents wasting ink more than the amount of suction required maintaining good printing. When the low printer of a running cost could be offered and the amount control means of (3) suction ink is used as a motorised piston pump, Components mark do not increase that what is necessary is just to control the engine speed of a motor. (4) ink-jet head It has a heater for regurgitation inside a nozzle, and since in the case of the head which carries out the regurgitation of the ink droplet using growth of the air bubbles energized and produced at a heater the number of empty tanks is detected by the abnormality temperature up of a head and the amount of suction can be controlled, it is not necessary to establish a special ink residue detection means.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the sectional view of one example of the black ink cartridge of this invention.

[Drawing 2] They are the recording head of this invention, and the perspective view of one example of the ink tank circumference.

[Drawing 3] It is the typical sectional view showing the detail of one example of the purge unit of this invention.

[Drawing 4] It is the perspective view showing the whole ink jet printer which carried the cartridge of drawing 1 , and the head of drawing 2 .

[Drawing 5] They are the recording head of this invention, and other perspective views of one example of the ink tank circumference.

[Drawing 6] It is the sectional view showing the internal structure of a gear pump.

[Drawing 7] It is the graph which shows time amount change of negative pressure.

[Drawing 8] It is the typical sectional view of one example of the ink tank of this invention.

[Drawing 9] It is the general-view perspective view showing the whole of one example of the ink jet printer of this invention.

[Description of Notations]

- 1 Head
- 2 Ink Delivery Pipe
- 3 Ink Feed Hopper
- 4 Ink Cartridge
- 4a Ink cartridge (color)
- 4b Ink cartridge (black)
- 5 Distributor
- 6 Recording Paper
- 7 Carriage
- 8 Paper Feed Roller
- 9 Leading Screw
- 10 Guide A
- 11 Guide B
- 12 Delivery Roller
- 13 Purge Unit
- 16 Spur
- 17 Cap Rubber
- 18 Purge Box
- 19 Joint
- 20 Ink Absorber
- 21 Cylinder
- 22 Piston
- 24 Silicon Tube
- 30 Tank One Apparatus Head
- 31 Cap

32 Gear Pump
33 ** Ink Tube
34 Suction Tube
35 Ink Suction Opening
36 Ink Exhaust Port
37 Pump Case
38 Pump Gear A
39 Pump Gear B
40 Open Sand Mold Ink Tank
41 Open Hole
42 Tank Stationary Plate
43 Valve
44 Seal Bush
45 Seal Rubber
46 Ink Delivery Pipe
47 Joint
48 Valve Spring
49 Ink Passage Joint
50 Tube Joint
51 Ink Tube
53 Ink Hole
116 Carriage
117 Drive Motor
118 Driving Belt
119A, 119B Guide shaft
120 Ink Jet Head Cartlidge
122 Motor for Cleaning
123 Driving Mechanism
124 Platen
126 Cap Member
130 Blade
130A Blade attachment component

[Translation done.]